



Social Impacts
of Computing

R. Kling
Editor

The Impact and Use of Computer Technology by the Police

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Over the past decade there has been a significant growth in the use of computer technology by U.S. police departments. This growth, however, has been at a slower rate than predicted in the early 1970's. Further, when computer applications extend beyond "routine" uses to "nonroutine" efforts, such as resource allocation or computer-aided-dispatch systems where the machine begins to become a tool for decision making, strategic planning and person/machine interaction, the results of the technology to date have been mixed. This paper reports on case studies and surveys which provide insights on the implementation and impact of police computer technology and the relationship of this technology to law enforcement and society.

Key Words and Phrases: computer technology, innovation, police resource allocation, police command and control, computer aided dispatch, law enforcement, technology transfer

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For a more detailed discussion of the cases and research described in this article see Kent W. Colton (Ed.), *Police Computer Technology: Implementation and Impact*, Lexington Books, Massachusetts, 1978.

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Introduction

The use of computer technology by the police has expanded rapidly since the mid-1960's. A number of factors have fueled this growth. Given the labor-intensive nature of police work and the tradition of devoting only a very small percentage of departmental resources to research and development, interest focused in the 1960's on improving police services by allocating dollars for equipment and technology. Recommendations in 1967 from the President's Commission on Law Enforcement and the Administration of Justice (The Crime Commission) suggested that technology might be an important tool for police work, and federal funding from the Law Enforcement Assistance Administration (LEAA) provided added resources to purchase such equipment [27, 28]. The pressure from vendors to sell their product—starting prior to 1967 but heightened as the Vietnamese War ended and technology-orientated industries sought to increase their domestic market—contributed to the expansion of computer-related innovations [7].

A number of unanswered questions remain about the use of this technology. Critics claim that much of the money has been wasted and that such innovations do not significantly increase the efficiency or effectiveness of crime control [2, 33]. Advocates are more optimistic that the costs are justified. However, although considerable attention has been devoted in the police literature to promoting technology, surprisingly little has been written about its implementation.¹ Despite recommendations from the prestigious Crime Commission,² the process of introducing change requires more than directives from the top. Important behavioral and power relations are involved, and the law enforcement community must address such questions as how decisions to implement technology are made, how various groups within the police react, and what impacts result. Such questions address the consequences and the diffusion of innovation. With these concerns in mind, this paper will examine the use, evaluation, and impact of computer technology by the police in the United States. Four areas have been especially important in evaluating computer technology in general and specific applications in particular. In many respects these four issue areas provide a general framework of evaluation for this report:

1. *Does the application of computer technology work?* Innovations often look good on paper, but does the technological change stay in operation for a period of years, and does it meet the objectives that were specified at the time of implementation? Such questions may be simple, but many innovations have failed to overcome this first "operational" hurdle.

2. *What have been the "technical impacts" from the use of computer technology?* Technical impacts are benefits resulting from improvements in the input, processing, and output of information. In essence, they are improvements provided through technology which help

Fig. 1. Computer application uses.

Application Areas	Computer Application Areas
Police patrol and inquiry	Allows a police officer to make rapid real-time inquiries about identification of people or property (wanted, missing, or stolen). Applications include files of outstanding warrants, stolen property files, and listings of registered vehicles and their owners.
Traffic	Includes automated records of traffic accidents, citations, and parking violations. Applications provide statistical data and can bring improved revenue collections.
Police administration	Use corresponds closely to computer use in other governmental areas and in business organizations, including personnel records, payrolls, budget analysis and forecasting systems, inventory control files, and fleet maintenance records.
Crime statistical files	Includes basic files on the type and number of criminal offenses and arrests and on juvenile criminal activity. Records are used in filling out reports (such as the FBI Uniform Crime Reports), and for a general law enforcement data base.
Miscellaneous operations	Includes files related to jail arrests as well as files related to intelligence records.
Resource allocation	Applications used to analyze police service and provide for the allocation and distribution of patrol units. Also applications for traffic resource allocation.
Criminal investigation	Includes basic files on crime patterns, modus operandi (an individual or group pattern, or a method of operation), automated access to field interview reports, nickname files, and fingerprint matching.
Command and Control	Provides for the automated or partially automated "command and control" of field units. Includes, for example, computer-aided dispatch (CAD) systems and automatic vehicle monitoring (AVM) systems to track the location of police vehicles. (Such systems generally require a geographic base file for the city.)

to bring better information—for example, greater speed of processing, availability of new or more complete data, accuracy or consistency of outputs, lower costs of processing data, and/or wider distribution of information.

3. *What, if any, have been the "service impacts"?* Service impacts are broader and more elusive than technical impacts. Whereas technical impacts do not address how information is actually used or whether innovations achieve changes in police performance, service impacts are concerned with the degree to which the public is served and whether or not computer technology contributes to the quantity and quality of this service and to the overall tasks of the police.

4. *Have there been "power shifts" through the use of computer technology?* Power shifts are gains or losses in one person's decision-making effectiveness which are often made at the expense of another person. Changes in organizations, techniques, or decision making processes often result in some shift or redistribution of the relative power of the actors involved. For example, does technology provide greater centralization or decentralization of the police; does it shift power to higher level officers,

or does it alter police personnel or structure? Does it bring the loss of individual control over information, and does it impinge upon a person's privacy?³

This paper will not answer all these questions concerning the application of computer technology. Still, such a framework provides a useful beginning for review and is used in several of the later sections of the paper. This article is divided into four parts. The first section reviews the use and evolution of information technology; the second assesses routine computer applications; the third analyzes computer technology in selected nonroutine uses; the fourth section includes some final thoughts about impact and implementation.

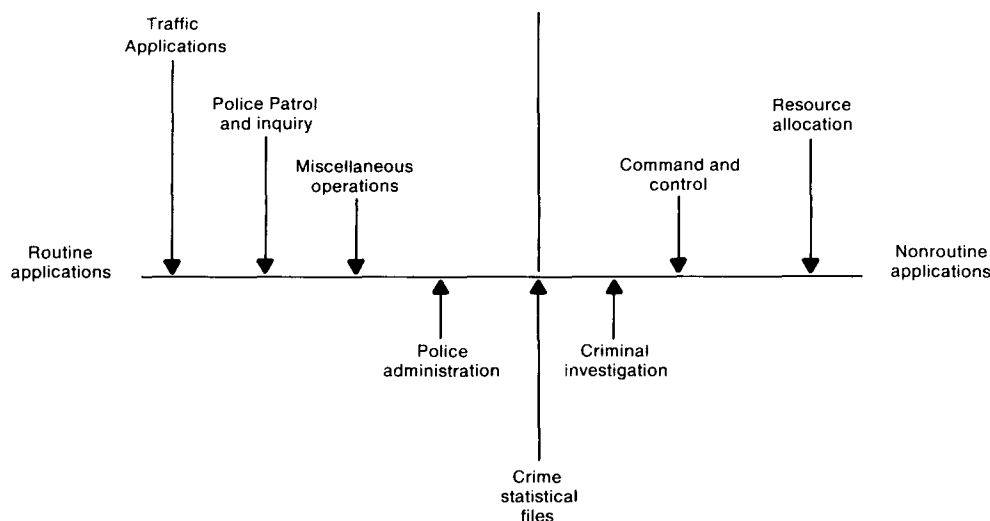
Before proceeding, several caveats are in order. Although many aspects of computer technology in law enforcement are well-established and expanding, it would be a mistake to think such innovations will play a dominant role (at least in the short run) in revolutionizing the police or many of the issues they face. To a large extent, police work is determined by the conditions of our society and its people. Crime and law enforcement have a momentum of their own.⁴ Computer technology may have a marginal role in influencing and shifting relationships, but the major law enforcement issues must be resolved in the context of society as a whole. Further, the questions to be addressed are more than just whether financially the benefits justify the costs. Because of the fragmentary nature of police work and the variety of styles of police behavior, the circumstances in each police department differ. Some have put up more resistance to technology than others, and some have achieved greater success. Although this report will try to draw general conclusions, ultimately costs and benefits and final impacts will depend on individual goals, priorities, and structures.

The Use and Evolution of Computer Technology by the Police

The first real-time police computer system in the U.S. was installed in the St. Louis Police Department in the mid-1960's [8]. Since then, the growth of computer technology within police departments has been widespread. However, surveys conducted as part of this study in 1971 and 1974 revealed that implementation has been slower than expected. The 1974 survey was mailed to all U.S. police departments in cities with populations over 50,000. Of the 326 (80 percent) that responded, 193 (56 percent) were using computers. Although this was an increase of 12 percent over 1971 responses, it was only about half the growth predicted by the earlier survey.⁵

Some of the difference may be explained by a slight variation in response rate between the two studies and by varying interpretations of survey questions. But, more important, estimates of future growth tend to be overly optimistic. The slower rate may also indicate that some police departments are taking more careful and sophis-

Fig. 2. Routine and Nonroutine Uses of Police Computer Technology. Just as routine and nonroutine categories are not sharply defined distinctions, the placement on the continuum of the eight application areas is not intended to reflect any absolute classification. Rather, each application area generally has at least some routine and nonroutine properties, and placement on the continuum is a general reflection of relative emphasis.



ticated approaches to computer use. A healthy pragmatism—and sometimes even skepticism—exists in many departments.

As part of the survey, police departments with computers were asked to identify which of 24 applications they were using. The 24 applications were grouped into eight areas: police patrol and inquiry, traffic, police administration, crime statistical files, miscellaneous operations, resource allocation, criminal investigation, and command and control. (See Figure 1 for a description of each of the areas.)

In evaluating use and impact, a useful distinction can be made between routine and nonroutine applications of computer technology.⁶ Routine applications involve the relatively straightforward, repetitive manipulation and inquiry of prescribed data, often by means of a definite procedure. The same manipulation was usually done by hand before the advent of the computer. Technology simply makes the process quicker and easier. For example, although police patrol and inquiry applications are technically advanced and provide rapid retrieval of information to the field officer, such inquiry systems are relatively straightforward and the tasks can be labeled routine. Other routine application areas comprise traffic files, crime statistical files, police administration, and miscellaneous operations.

In nonroutine applications the machine becomes a tool for decision making, strategic planning, and person-technology interaction. There are no absolute methods for handling problems, either because the area is complex or because they require custom-tailored treatment. The human decision-maker plays a vital role in judgment, evaluation, and insight. Nonroutine application areas in law enforcement include resource allocation, investigation of crime, and command and control—including

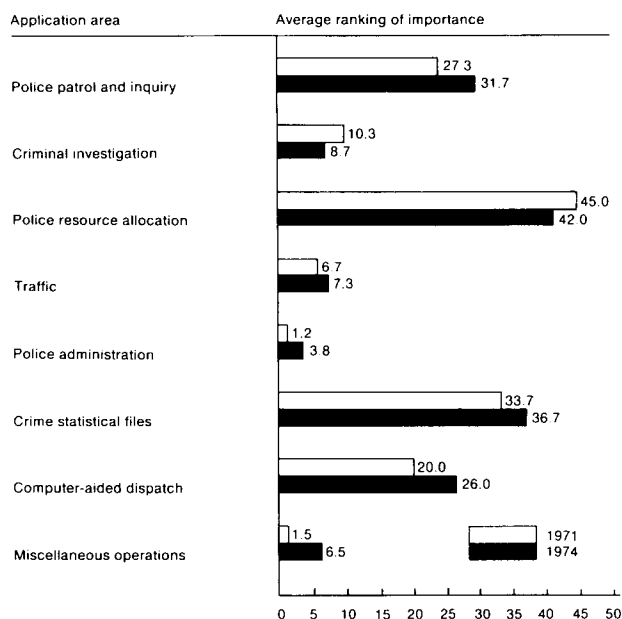
computer-aided dispatch and automatic vehicle monitoring. (See Figure 2.)

Routine and nonroutine categories should be regarded as delimiting the two ends of a continuum. As applications move toward the nonroutine end of the continuum, systems design becomes more intricate, and behavioral, personality, and organizational considerations become more significant [17]. Several applications fall between the two extremes. The best example is crime statistical files, which though generally routine in collection and processing, provide the basic data for a number of nonroutine activities, such as resource allocation. Command and control applications also have both routine and nonroutine dimensions.

Successful implementation has often been limited to the routine areas. Traffic, police administration, and crime statistical files have all remained important; and the expansion of police patrol and inquiry records—especially in the late 1960's and early 1970's—has been almost phenomenal.⁷ In the nonroutine area, though, results have been far more disappointing. For example, in the 1971 survey, 61 departments predicted they would implement a computer-aided dispatch system. However, only 15 such systems had been installed by 1974—less than 1 percent of the computer applications reported in the 1974 survey [7, 8].

Resource allocation has been the only nonroutine computer use where the number of applications actually implemented has exceeded expectations. The 1971 survey results indicated that in three years 12 percent of all computer applications would be in the resource allocation area; the actual percentage was 16 [7]. An additional question in both the 1971 and 1974 surveys asked police departments to rank the relative importance of different computer applications. There was little shift between the

Fig. 3. Importance of computer applications in 1971 and 1974, as ranked by police departments responding to the surveys. (N = 193.) Ranking is based on the average number of times applications were selected by police departments as one of their three most important applications.



two years, and in both 1971 and 1974 resource allocation applications were ranked first (Figure 3).

Although the actual level of implementation has been below earlier expectations in a number of areas, the computer, with all its interesting implications and problems, has unquestionably become a permanent part of law enforcement technology after a decade and a half of use. The issue now is not will computers be used, but how and with what impact?

Routine Applications

In analyzing police computer use, routine applications will be examined against four areas of evaluation outlined earlier. Although the data are limited and results vary greatly, routine applications have often succeeded at the *first level of evaluation—successful operation and meeting objectives*. Numerous police patrol and inquiry applications and crime statistical files are working around the country today. For instance, seven-second retrieval of information to the officer in the street has been a reality in Kansas City, Los Angeles, and other police departments for a number of years. On the other hand, as the 1974 survey results indicate, the rate of implementation has been slower than expected; and even with routine uses of computer technology, success varies significantly among police departments because of human rather than technical considerations. Furthermore, large resources from the LEAA have in some cases served as a “seductive stimulant” for police departments

to get involved with computer technology in the absence of an intrinsic desire for understanding. As one police data processing manager put it, “millions of dollars have been spent, but there’s still an awful lot of garbage coming out of police computer systems.” Although no one knows how much waste and misuse exist, police computer hardware has undoubtedly been sold to police departments which do not know how to use it or for nonessential applications.

At the *second level of evaluation—technical impacts*—computer technology has provided a number of positive benefits. In at least some departments extensive amounts of new or better information are available more rapidly for broader distribution, although results again vary among police agencies. However, technical benefits do not address how information is actually used, nor do they measure changes in police performance. This must be examined at the third level of evaluation—service impacts.

At the *service impact* level, though, the information available is even less clear. In reviewing more narrow process-orientated measures of efficiency, a number of routine applications have improved service to the public and shown to be cost-effective.⁸ Although full-scale analyses of costs and benefits were not covered in this project, illustrations of the process service benefits can be discussed. In Tulsa, Oklahoma, an additional \$180,000 in estimated revenue was returned after the first year’s operation of a new automated traffic citation system. In Long Beach, California, membership in an automated want/warrant system in the Los Angeles area increased the number of 1970 warrant arrests 31.5 percent over 1969 figures.⁹ In Kansas City, Missouri, the ALERT (Automated Law Enforcement Response Team) system was installed in 1969, and the number of monthly inquiries per police officer concerning stolen cars or wanted persons rose from 36 in January 1970 to 90 by May 1971, and in 1975 police officers were averaging 250 inquiries per officer per month. In Oakland, California, after digital computer terminals were installed in half the patrol cars in 1971 and 1972, units with terminals in their cars made more than seven times as many information requests, received more than three times as many “possible hits,” and were three times as productive in warrant arrests and vehicle recoveries as nonequipped units.¹⁰

However, when one examines the actual service results or outcomes of such routine applications, several unexpected impacts and influences become evident. For example, a former Kansas City Chief of Police reported that after installing their ALERT system, one of the most advanced police patrol and inquiry systems in the country, the police department experienced an overload of police officers making stolen car checks, thereby creating a potential manpower drain and shifting concentration from other vital police tasks such as preventive crime patrol.¹¹ In addition, it is extremely difficult to measure the effectiveness of technological innovations in combat-

ting crime. Crime statistics are a product of a wide range of influences such as time of day, season, weather, unemployment and economic condition, neighborhood development patterns, political activity, community unrest, and reporting requirements. Relating the use of routine technological innovations to changes in crime statistics requires an enormous and unwarranted "leap of faith." Efforts to relate the impact of technological innovations to crime pattern changes are therefore wasted. We are far better off to simply admit the difficulty of trying to correlate technological, or for that matter, any other enforcement changes, with broad social indicators of crime. Further, even if we discard crime as a yardstick and try to evaluate performance based on other measures of police activity, there is always the risk that undue emphasis will be given to those indicators which can be most easily measured—such as the number of car checks or arrests for stolen property.

Finally, as far as service impacts are concerned, it seems that routine computer uses by the police have almost entirely been devoted to the crime control and law enforcement functions of the police.¹² By overemphasizing the application of technology to crime control, law enforcement agencies neglect possible applications to social service activities, for example, computer files to assist with referral information, medical assistance, or listings of agencies and names of people who might provide social service assistance.

In the *fourth area of evaluation—power impacts*—the results of computer technology are the most ambiguous. Individuals could potentially lose control of personal information, so safeguards to assure privacy and security are necessary. Further, computer technology may shift power within police departments, allowing those who are more quantitatively and technologically orientated to gain influence.¹³

Nonroutine Applications

Although the service and power shifts of routine computer applications raise certain questions and concerns, in general in terms of operational performance and technical impact, a number of routine applications have been successful. However, nonroutine uses of computer technology bring greater complexity both in terms of implementation and evaluation. In this study, case studies have been conducted in two areas of nonroutine use—resource allocation and command and control. Each will be discussed below.

Resource Allocation

As noted above, in surveys in both 1971 and 1974, police departments considered resource allocation to be their most important area of computer use. All police departments must make deployment decisions and the interest in the use of technology to aid in this allocation process is growing. However, the interest in automated

police deployment should be placed in the context of a realistic understanding of the law enforcement environment. The resource allocation applications noted in surveys generally refer to using tabulations of crime statistics to determine deployment, not to more sophisticated models.¹⁴ Even where modeling work has been tried, many of the efforts have met with only limited success, as the three cases examined as a part of this study indicate.¹⁵

In St. Louis, the use of a computer model that was implemented in the late 1960's is purely optional as of 1977, and district captains no longer request computer-generated reports. The command staff and the Board of Police Commissioners do nothing to encourage use of the system by other commanders. In Boston, efforts were made to implement a computer simulation model in the early 1970's but the proposed deployment techniques were dropped entirely in 1973, and questions have even been raised within the police department concerning the manual resource allocation procedures that were implemented in 1974.

Of the three cases reviewed in this paper, the Los Angeles Police Department (LAPD) has the only resource allocation system utilizing computer technology which is actually operating and established as a part of its deployment process. The first level of evaluation—having a working system—has been met. However, even there, the objectives of the resource allocation project were substantially modified. The original LEM-RAS/ADAM deployment model¹⁶ was dropped in 1974 to be replaced by the ADAM historical reporting system which was implemented in June 1975. The current ADAM package no longer includes forecasts of future needs, and deployment recommendations are based on manual calculations using computer-generated reports of historical data. The LAPD has achieved technical benefits in terms of reducing the manpower required to analyze workloads and to calculate deployment plans, but many of the service impacts are still unclear. For example, conflicts arose between the deployment model and team policing. (Team policing is an overall strategy for police work implemented in the LAPD which will be discussed later.) Also, questions arose in terms of responding without delay to calls-for-service. Finally, one of the original service objectives of the initial allocation system, improved crime prevention, has been virtually abandoned as one of the factors considered in the current ADAM historical reporting system.

Efforts in police departments to utilize computer technology in resource allocation go far beyond the St. Louis, Boston, and Los Angeles case studies. The modeling techniques used in these three cases are now outdated, and improved models have been developed. For instance, a number of projects are currently underway to implement two more recent modeling efforts: the Patrol Car Allocation Model (PCAM) and the Hypercube Model.¹⁷ These models allow the user to identify a wide range of performance measures—i.e. mean travel times

to various locations, workload balances, response to call-for-service and other dispatching strategies—and based on the relative importance of these various measures, alternative deployment strategies are provided. As a consequence, some of the objections in St. Louis and Los Angeles—that those modeling efforts did not consider enough of the relevant factors—have been overcome. The actual results of most of these efforts still must be evaluated, though. Further, the implementation problems encountered in the three cases discussed in this paper do not seem to be isolated instances. Rather, there is strong evidence that such difficulties are commonplace. According to a 1975 report by the RAND Corporation that examined a number of attempts to implement computer models in the criminal justice area: “Through a series of interviews with model builders and personnel in agencies that attempted to implement models, a picture of the implementation process was obtained. In general, criminal justice models have failed to achieve any notable level of use for policy decisions.”¹⁸

What can be said, then, about the various efforts to utilize computer technology in police resource allocations? Five conclusions have been drawn.

1. *Many of the early predictions and promises concerning computer-aided resource allocation systems have not come true, and our expectations for the future should be altered accordingly.* At one time some advocates argued that the use of computers and modeling might result in the almost daily reallocation of police units. An officer reporting for duty would call in and be assigned to patrol or to answer calls in an area designated through the analysis of available data and the aid of modeling technology. This type of “fluid patrol” is very unlikely to occur on a widespread, ongoing basis. Rather than looking for a long-term implementation of computer-aided resource allocation to redesign police deployment on a daily basis, we should expect the use of the modeling techniques on a more limited basis; police departments might use computer technology to redesign their patrol structure at a point in time and then wait for several years or at least three to six months to restructure patrol beats.

2. *Many of the problems in implementing computer models are the result of behavioral and organizational difficulties.* Past experience has shown both a misunderstanding of the nature and environment of technological change, and a failure to properly manage innovation. The case studies referred to in this paper demonstrate the difficulty of getting police users involved in modeling efforts. Of the three cases in this study, only the Los Angeles ADAM historical reporting system is currently in operation, and even in this case it took eight years for implementation. This highlights vividly the need for a long time frame, the involvement of command leadership, the continuity of personnel over time, and a number of other implementation factors.

3. *Despite past disappointments, police computer modeling efforts should not be abandoned. We should*

continue to seek improved methods for police resource allocation, but with a more realistic perspective. Since all police departments must deploy their resources in some manner or other, technology may assist in more effectively identifying and responding to future needs, if the right criteria are built into the models. Further, use of the technology may aid the operations of the police, not because the model *per se* will improve the system, but because law enforcement personnel may become more educated and involved in the decisions made. However, if this education is to be meaningful, it must be two-way, not only involving the model builders, but extensively involving the model users as well. It is difficult to involve law enforcement decision-makers in such a process, not only because of differences in style and approach, but because the complex world of policy management faces immediate demands. The police commander who has day-to-day decisions is often unable or unwilling to afford the luxury of model building and analysis.

4. *As computer modeling work is continued, evaluation is essential: Careful consideration should be given to a systematic program to evaluate such technology.* Any claim about the impact on performance of advanced deployment models will remain largely speculative until more careful research and evaluation is carried out. The time may be appropriate to develop a more systematic program of evaluation, and there should be a multidisciplinary experiment to test alternative resource allocation strategies. It is only through such an experiment that it can be determined whether, or to what degree, development and implementation of such police technology are warranted.

5. *Finally, and perhaps most important, there is no one best way to allocate law enforcement resources.* Rather, there is a range of alternative strategies, and each implies a different, sometimes subtle, set of consequences. The computer cannot prescribe the ideal method. When embarking on the implementation of innovation, it is important to review and understand the consequences of alternative policing strategies and to realize that the use of technology is not value-free. The experience of the LAPD is especially informative in illustrating this point. Team policing and the resource allocation model, ADAM, represented two separate philosophies of police work. ADAM placed priority on responding to calls-for-service, generally irrespective of patrol beat assignments. Team policing focused on assigning patrol officers to one area of the city to prevent crime. A conflict appeared when ADAM was implemented in the team policing environment. The problem was not the ADAM system, *per se*; rather, there were two different strategies involved, both with very different purposes.

Any resource allocation system is obviously based on some basic set of criteria or decision rules used to deploy resources. To obtain the best results, a police department must select rules compatible with its basic objectives. A department must be especially careful in buying from a vendor a preprogrammed system relying on a set of

decision rules which are essentially unknown to the department. The result may be unexpected or yield the wrong consequences. Certain criteria—for example, responding to calls-for-service—may be given emphasis when, indeed, other aspects of police work such as community service and police presence may have a higher priority. Emergency response to calls-for-service comprise only a small portion of the actual police work, yet it is possible that such measures can become primary criteria for allocating resources if departments fail to take the time to think carefully about their deployment strategy.

Command and Control

The potential for automating aspects of police command and control operations were first pointed out by the Crime Commission in 1967. Computer-aided dispatch (CAD) systems provide the framework for bringing together many of these new tools through the partial automation of the call answering and dispatch process. Other command and control technological changes that have been considered or tried include mobile and portable digital terminals to allow officers in the street to communicate digitally with headquarters, automatic vehicle location (AVL) and automatic vehicle monitoring (AVM) systems to keep track of the location and monitor the status of police units, and 911 emergency telephone services.¹⁹ A CAD system may include AVM or AVL systems, 911 telephone service or mobile digital terminals.²⁰ Some of these innovations in command and control are routine; the technology basically replaces a previously manual activity such as with digital terminals or the automated transfer of information from the telephone operator to the dispatcher. However, CAD also provides the framework for a number of nonroutine activities, such as tracking and monitoring vehicle location, automatically timing the length of calls and raising a “flag” if a call takes over a specified time (say 30 minutes), or providing new information to be used for management. Command and control as discussed here then, relates not only to dispatch deployment, but to the ability of police administrators to control and modify the manner in which police operations are conducted.

This paper will briefly discuss three cases within the command and control area—efforts to establish CAD systems in Boston, New York City, and San Diego.²¹ A fourth case on the implementation of a Phase I AVM system in the St. Louis police department has also been documented and reported elsewhere in the literature [24].

As reported earlier, the 1971 and 1974 ICMA survey results indicated that the implementation of CAD systems has been far slower than initial anticipations. As further confirmation, a 1975 study found that of the 135 police departments in jurisdictions with a population more than 100,000, only about 10 percent had a CAD program.²² The use of CAD systems is just beginning, and a number of obstacles have been encountered in the

installation process. However, in San Diego and New York City, working systems have been developed, although in Boston, the problems of introducing the new technology have been more significant. In reviewing the four areas of evaluation outlined earlier, the successes and failures of the three case studies provide seven insights for the future.

1. *It is possible to establish ongoing, operational CAD systems.* The SPRINT system in New York City has been working since 1970, and the CAD system in San Diego has been operating since 1975. (The system in Boston, though, has experienced a number of major difficulties.)

2. *Both San Diego and New York City have achieved technical benefits from CAD.* Such benefits include increased information availability, rapidity in matching addresses with geographic location, the effective transfer and recording of data in the dispatch process, and the retrieval of information from the dispatch process.

3. *Both cities have experienced positive service impacts in terms of process-orientated measures.* Some of these process service benefits include: telephone calls are answered and serviced more rapidly (telephone talk time in San Diego has dropped from 3 minutes to 77 seconds, and the average time required to answer the telephone is 2.5 seconds); standards can be set for communications and field backlogs (New York City has met its standard of answering 98 percent of telephone calls within 30 seconds, and radio air-time delay and field backlogs are monitored and recorded); and the workload has been more evenly distributed within communications divisions.

However, when it comes to measuring the actual service “results” attributed to CAD, the findings are inconclusive. In the New York City and San Diego police departments there is a general feeling that dispatch time has been reduced, but there is inadequate data to prove or disprove such an hypothesis. In fact, to the extent that data exists, it seems to show that the impact on response time has generally been negligible or modest at best.²³ Further, the police departments have essentially not analyzed the influence of the CAD systems in such areas as improving police productivity by enabling patrol officers to respond to more calls per shift or providing a better match between police service needs and available resources.

4. *The power impacts and the cost-benefit ratio of CAD systems are still unclear.* CAD systems highlight the importance of the dispatcher in the delivery of police services. As greater information increases the ability of the dispatcher to carry out his or her job, it also increases influence and power of communications personnel. In Boston, some of the resistance to CAD technology resulted because of a fear of increasing the power of the dispatcher. Another potential power shift relates to the ability of police administrators to control and modify the manner in which police operations are carried out. Both the New York City and San Diego CAD systems provide

a wide range of new information to managers. A number of reports are regularly produced and distributed in New York City, and in San Diego, lists of available reports are circulated to police personnel with further documents provided upon request. Such data offer a rich potential for the better management of police field resources and dispatch personnel and for bringing greater authority and control to police managers. However, the ultimate impact will depend on the ability of law enforcement administrators to analyze and use this information effectively as a resource.

The question remains, then, as to whether the benefits of CAD justify the costs. Although the expenses of much of this technology seem high, when placed in the overall context of the costs of police operations, the comparative magnitude of the dollars seems to diminish. In New York City, for example, the annual costs for developing and operating the SPRINT system are about \$2.7 million. Because the 1975 police budget in New York City was approximately \$625 million, only $\frac{4}{10}$ percent of the annual budget was devoted to the CAD system. Stated in another way, the costs of operating SPRINT are roughly equivalent to maintaining 10 police patrol units on an annual basis.

In both New York City and San Diego, technical and service benefits have been achieved to help offset such costs, and it seems highly likely that the use of CAD systems will continue to expand. Whether their full potential is achieved, though, will depend on the skills of the management personnel. In the past, police chiefs have seldom considered themselves as managers; rather, their responsibility has been to balance pressures within and without the city and to promote the need for law enforcement and police resources. Consequently, it is still unclear as to whether they or their assistants will be able to channel the potential technological talents of the computer to do more than simply perform routine operations.

5. *The three CAD cases point to the complexity and importance of implementation.* In Boston, a number of factors were identified which contributed to the problems of installing a CAD system in the police department: lack of involvement by career department personnel in formulating the program, prohibition of outside consultants from working closely with department staff and field personnel who would use the new system, and lack of progress reviews with field personnel. Police officers are often suspicious of change, and CAD has the potential for huge modifications in police operations. Where possible, police must be involved in identifying the need and designing the operation of technological innovations. It is possible that the CAD system in Boston will someday become fully operational, but behavioral, technical, and political obstacles must first be overcome. In San Diego, great care was made to train personnel and to involve dispatchers and operational officers in the design of the new system, and this approach certainly contributed to their apparent success [13]. Even in San Diego,

though, the primary problems up to now relate to behavioral difficulties (such as boredom, monotony, and isolation of the personnel in the communications center from the rest of the police department). A special 90-hour training program was developed for telephone and dispatch operators, but in 1976 personnel shortages forced the department to rely on on-the-job training instead, at least in the short run.

6. *The relationship between the user and the vendor must be clearly defined and performance guidelines for CAD technology must be specified.* Although San Diego had a very clear set of vendor specifications in the request for proposal for the CAD system, the Boston proposal lacked the same clarity and misunderstanding inevitably developed. In the long run, both the police and the vendors of technology will benefit from a clear framework and set of standards and specifications. Effective implementation necessitates such standards.

7. *Finally, the time is appropriate for a more thorough evaluation of CAD technology in the law enforcement community.* Although some systems are still in operation, others have met with only limited successes, and the reality is far below initial expectations. Still, the interest in CAD among law enforcement agencies appears to be high, and a number of vendors are actively promoting their products, sometimes without standards, clear performance guidelines, and balances. A thorough evaluation of such technology should be undertaken to identify both the advantages and problems that have occurred to date and to outline a clear set of performance guidelines for users and vendors in considering the implementation of a new CAD system. Such an evaluation could play an important role in the process of technology transfer (or nontransfer) both in terms of realistically educating interested departments in the benefits and the costs of such innovations and in terms of identifying possible "pools of resources" to aid in the transfer process.

Power Shifts

While it is easiest to focus upon the direct or technical costs and payoffs of computer use, side effects may also be important. Analysts (such as Downs [9] and Kling [16]) have noted that computer-based information systems may result in important shifts of social power amongst the participants in computer-using organizations. Determining such power impacts poses a more difficult research problem than probing technical or process-oriented service impacts [19]. No major shifts have been identified in this study but subtle changes may be forthcoming. The emphasis in Kansas City on conducting computer searches versus other types of law enforcement activities is one indication, and the conflict between team policing and the LEMRAS/ADAM system in Los Angeles is another. The very fact that computer technology places greater emphasis on quantitative approaches to the law enforcement problem may cause power shifts to occur.

Clearly, personnel in the law enforcement commu-

nity have had more impact on technology than the reverse; but again, subtle shifts may occur in the future. The results of the previously cited 1971 and 1974 surveys indicated that people with more quantitative backgrounds seemed to be gaining in terms of their importance in police departments along with those who have a greater ability to utilize computer technology.²⁴

Finally, it is possible to argue that computer technology may lead to a greater centralization of police structure and power.²⁵ However, based on closer examination, it seems that computers themselves do not cause centralization or decentralization. Rather, they are tools that can be used to move in either direction. Centralization may be the most common result, but it does not necessarily follow.²⁶

Students of technology and society have largely abandoned the view that computers and other technologies will impinge directly on institutions and organizations, causing dramatic collisions and changes of direction. Computer technology does not create social forces or trends; rather, the application and the use of new technologies are strongly influenced by political forces and social values. This is especially true in law enforcement. During the last decade, a number of scholars have debated the nature and causes of crime problems, only to realize how difficult it is to trace the relationships between alternative "solutions" and the crime rate. Nevertheless, technology may well support or enhance established trends or directions of change. They may make powerful people more powerful, and established practices more set.²⁷

Conclusions: Police, Computer Technology, and Society

Even if computer technology can be implemented successfully, important questions remain about the final impact of this technology and the benefits and costs. In 1967 the Crime Commission stressed the use of technology in law enforcement, and was optimistic about the potential for such innovation. Since then, we have learned a great deal; quick solutions should not be expected, and costs accompany any benefits that are achieved. In a narrow sense, as we have seen here, there are technical and service impacts stemming from the routine use of computer technology, and in the area of nonroutine use, indications of technical and service improvements have also been documented. However, we have learned to expect little impact from computer technology on crime and the basic law enforcement issues. Crime is rooted in a large mixture of factors; technology can do little to alter these conditions. No one should expect the computer to change the direction of law enforcement dramatically. The best that can be expected are marginal improvements. There is a range of views about the use of computers and technology in our society. At one extreme are those who see the increasing movement towards a technologically sophisticated society as

dangerous, a movement that will take us away from the "good life." Scientific rationality and technological progress may have questionable results and set up a chain reaction which we may not be able to reverse.²⁸ At the other extreme are the technologists and the vendors who sell their products. They argue that the benefits of technology outweigh the costs and tend to oversell their products and to promise more than they can deliver [18, 20]. I believe that the truth lies somewhere between. On the one hand, computer technology has become a part of law enforcement activity. Given this reality, the most useful orientation is to realistically evaluate current needs and progress and to promote change where it is appropriate. On the other hand, we must admit that many of our efforts at technological innovation have failed. Promises have been overextended, expectations have not been met, and resources have been wasted. The answer to our problems does not lie in hardware; it lies in basic value judgments and in people. In talking about a computer application in his police department, one police sergeant astutely remarked:

The computer terminal in the car is an effort by the police department to professionalize from a hardware approach. This is O.K., but the more we concentrate on hardware, the farther we move from the basic people issues. The real police problems don't have technical solutions. Instead, it's the people who are screwed up, and we need more people-to-people type efforts in police departments, such as improvements in communication, improved motivation, productivity modifications, better inter-personal relations, etc. In short, instead of hardware solutions, we need policy resolutions of the basic issues of the police force. The result of the computer may be to take our minds off what are the more important issues.²⁹

In summary, most arguments against the computer are made on the grounds that too much money is currently being spent on law enforcement technology, particularly when it is not clear that the benefits of such technology justify the costs. However, this study has found that in many routine applications the benefits *can* justify the costs, particularly if benefits are defined in narrow, process-oriented terms. (Naturally, success regarding use varies from police department to department.) Further, this efficiency may continue to develop with time as computer technology becomes more sophisticated and police departments get better at handling the organizational and behavioral problems which often accompany the introduction of technology and the implementation of change.

Our emphasis upon improvements in technology and management differs from that of scholars such as Laudon and Kling [16-19]. They argue that the impacts of computing depend as much upon the social environment of the computer-using organization as it does upon the technology and policies used to manage it. However, organizations have little control over their environments. In seeking to improve their performance, they can best control the technologies they adopt and the practices they employ to manage their use.

More importantly, though, there are other more significant issues surrounding the use of the computer than questions of costs and benefits. The most pressing law

enforcement questions at this time are to define the basic task of the police, to identify how the officer's time is really being spent, to determine the correct allocation of resources, and to determine if current recruiting and training practices complement the basic needs and priorities of the police. The computer (along with proper analysis) may help in a small way to resolve these issues, but until such questions are addressed, the implementation of the computer may also serve to reinforce the status quo, to lock in and substantiate our present approach, and to indirectly countermand other innovation.

The greatest strengths of computer technology seem closely related to its greatest weaknesses. Computers have the potential to aid in criminal justice activities through the rapid communication of accurate and complete information, and perhaps a more rational approach to decision-making. We must realize that there are limits to this technology, though, and not overestimate the potential. These very benefits, if not properly controlled or planned, may result in misuse, unintended consequences, wasted resources, and frustrations. Expanded computer use by the police is at a crucial point and now is the time to point to a new direction, one slanting toward attention to evaluation and implementation, stressing performance standards and transfer, and realizing that police play a broader role in society than simply fighting crime. Such a new direction requires careful consideration so that the strengths of technology can be judiciously marshaled and the weaknesses and potential risks prudently forestalled.

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Notes

1. For a literature search on the use of computer technology by the police see [6], Ch. 2. Much of the literature has been prepared by vendors as a part of their effort to market their products. Comparatively little research has been devoted to implementation or evaluation (see [4, 6, 21, 25] for a few cases).
2. For some of the recommendations of the Crime Commission see [27], pp. 246–247, pp. 269–271.
3. Privacy concerns comprise some of the most important potential power shifts related to the use of police computer technology. Such concerns are not the primary focus of this article, but they deserve mention, however brief, since in the long run they may have a dominant importance. For further discussion of this topic see, for example, [26, 29, 34].
4. For discussions of this position see [6], especially Chs. 1, 8, and 14, and [39].
5. The 1971 and 1974 ICMA surveys were designed by the author and administered by the International City Management Association (ICMA). For more detailed descriptions of the results of the surveys see [6–8].
6. The terms “structured” and “unstructured” have also been used to draw a similar distinction. (See [12].) Also, Herbert A. Simon originally used the terms “programmed” and “unprogrammed” to make a related characterization. (See [32].)
7. For a detailed discussion and documentation of the routine applications referred to in this paper, see [6], Ch. 3.
8. In evaluation research a range of evaluation measures have been identified to review impact. In this study at least two levels of service impacts have been useful: (1) process measures and (2) results or outcomes measures. “Process measures” refer to changes in the time it takes to answer the telephone because of a new communications system or changes in the time required to provide the police officer with

information about a stolen car or wanted person. The emphasis for process measures is on efficiently delivering services with an improving ratio between inputs and outputs. “Results measures,” on the other hand, are more interested in the actual effectiveness and quality of innovations in terms of their impact on police service. Telephone calls may be answered more rapidly, but what difference does it make? If information is delivered to the officer in the field in seven seconds, what is the result or outcome? Because they reflect quality rather than quantity of service, results measures are often difficult to establish and more costly to collect.

9. Since warrants in the Los Angeles automated want/warrant system include both traffic and criminal warrants, it is likely that the major part of the 31.5 percent increase in warrant arrests was for traffic offenses.

10. Information concerning the computer systems in Tulsa, Long Beach, Kansas City, and Oakland are based on a series of “mini-case studies” on routine applications found in Ch. 3 of [6].

11. Phone conversation in 1973 between the author and Robert McNamara, former Chief of Police of the Kansas City Police Department.

12. Only a small portion of police time is devoted to law enforcement activities such as burglary in progress, check on car, make an arrest, etc. Rather, the large majority of police time is devoted to service (personal requests, animals, ambulance calls, utility problems, accidents, lost or found property, etc.) or order maintenance activities (family trouble, gang disturbances, neighborhood trouble, fights, etc.). See for example [40], p. 18, and [35], pp. 94–102.

13. The implications of such shifts will be discussed in the final section of the paper.

14. Of the police departments surveyed in 1974, 48 percent indicated that they use no mathematical techniques in deployment, 34 percent said they relied on some version of a hazard or straightforward quantitative formula, and only 18 percent responded that they used an advanced mathematical method, such as a computer simulation or computer-aided resource allocation approach. For a more detailed discussion of police deployment techniques see [23].

15. For a complete documentation and analysis of the three resource allocation cases discussed in the text which follows—St. Louis, Boston, and Los Angeles—see [6].

16. LEMRAS stands for Law Enforcement Manpower Resource Allocation System. ADAM stands for Automated Deployment of Available Manpower.

17. For a discussion of a hypercube model see [23]. For a review of the PCAM model see [5]. For a review of implementation efforts for these two models see [3], pp. 13–17.

18. See [4], p. xii. For further discussions of problems in implementing models and technology in public organizations see [1, 9].

19. A distinction has been drawn in this report between AVL and AVM samples. An AVM system provides a police dispatcher with real-time location estimates of each vehicle in a fleet, and through its monitoring function provides additional vehicle status information (for example, “in pursuit,” “enroute to scene,” etc.) An AVL system provides only location estimates without additional status information.

20. For a further discussion of the various components of command and control and computer-aided dispatch systems see [31].

21. The three complete cases are found in [6], Chs. 9 (Boston), 10 (New York City), and 11 (San Diego).

22. See [31], p. 3.

23. See [6], especially Chs. 10 and 11.

24. These results are found in [8], pp. 7–15, and [7], pp. 13–17.

25. For example, in a study of insurance companies published in 1970 (see [38], pp. 103–112), Thomas Whisler reports that the executives of those companies felt strongly that companies have brought about greater centralization, although there were differences of opinion as to the degree of change that had taken place.

26. In fact, in telephone interviews with a small sampling of police chiefs conducted as a follow-up to the 1974 survey, a sizeable number (10 out of 15) indicated that, with the computer, decision-making was becoming more decentralized. Because more information is available to field staff and district commanders, such managers should be able to make wiser decisions at a more decentralized level; see [7], p. 16.

27. See, for example [25], especially Chs. 6 and 11. Also see [37], pp. 609–614; Kling, [16] and [19].

28. For an interesting presentation of this argument see [26], especially Chs. 1 and 15.

29. Interview between Kent W. Colton and a police sergeant in Oakland, California, 1974.

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(Note. References [10, 11, 13–15, 22, 30, 36, 41, and 42] are not cited in the text.)

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